RESOLUTION FOR 1971: VERY HIGH!

HISTORY HAS A WAY of sneaking by when most people aren't looking. In a routine on-schedule delivery last August, a Cleveland, Ohio, firm turned over to the Air Force a shipment of non-silver film to be used in the duplication of aerial reconaissance pictures.

This was the first return for the Air Force, after ten years of funding research at Horizons Research, Inc. toward development of a high-resolution, dry-processed, non-silver aerial reconnaissance film.

The peculiar chemical properties of silver add up to such a huge plus in photography that the man behind the camera seldom gives a thought to any possible shortcomings the element may have.

Except for one, and it's a beaut: silver's getting scarce!

An all too foreseeable future with silver shortages had sent the test tube and spectroscope set back to their Bunsen burners to find an acceptable way of making photographs without the handy halides. It also served to focus attention on two other minus quantities besides the big minus of availability.

First of all, the grain size of the silver incorporated into the emulsion sets a limit to the resolution possible. Secondly, although it is taken very much for granted, silver materials require a rather complicated and—let's face it—inconvenient wet chemical process for development.

For these reasons the search for a non-silver process has been going along for quite a few years, not at all unsuccessfully.

"Probably the question we are most often asked relates to potentially competitive materials such as diazo and the vesicular films, as well as silver," reports Robert E. Whitner, president of PhotoHorizons, the film manufacturing division of Horizons Research.

"For certain potential applications, our material might be compared to diazo. Diazo is a material that has been around for many years and is used chiefly for making engineering drawings. Today it is also used in microfilm duplication. However, in most systems it requires unpleasant ammonia fumes to develop a high contrast image in a positive mode. A negative original cannot be reversed to produce a positive image, as is usually desirable, without an intermediate processing step. Our present duplicating film is at least three times faster than diazo and also has a negative working characteristic desired by most end users."

The word "vesicular" in vesicular films comes from the method in which the image is formed. When light strikes the film, small bubbles of nitrogen ("vesicules," or blisters) are created.

The image on the film is frosty white, and extremely non-conventional, and projects on the screen as a low resolution but high contrast black-and-white image. One might think of this material's small bubbles as analogous to the small grains of silver in silver halide film. Both serve to limit the resolution capability of the material, and consequently vesicular film has not found application in the duplication of aerial reconnaissance imagery and similar high resolution tasks. On the other hand, for many ordinary purposes, such as duplicating characters and numbers on microfilm, the various vesicular films on the market offer an attractive dry processed, negative-working material.

"For many reasons which involve fairly complex areas of photoscience, we prefer to view our material as a competitor to silver halide film rather than the vesicular films or diazo. The latter have inherent limitations in their photographic speed and resolution which have limited their application when compared to silver halide. The fundamental chemistry of both systems relegates them to rather limited use," says Mr. Whitner.

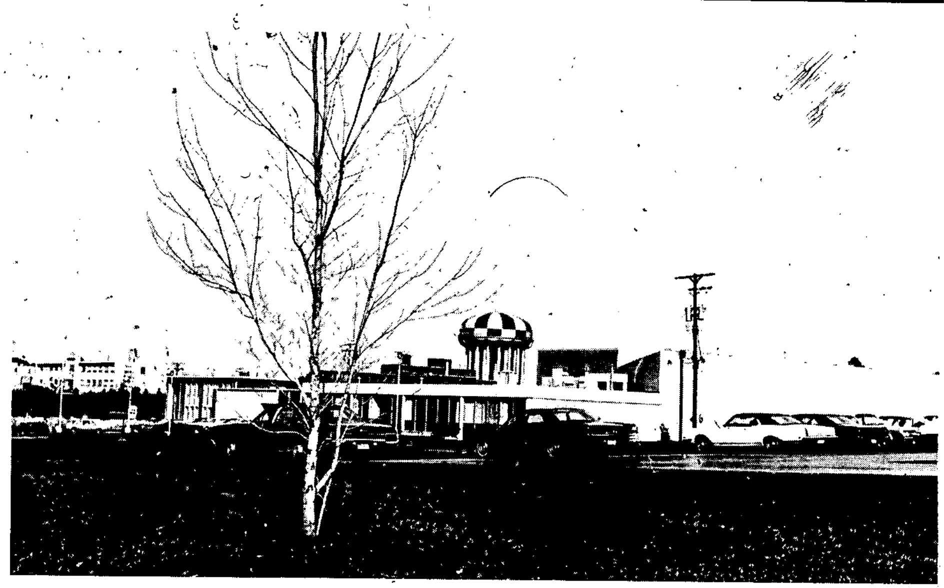
The fundamental chemistry of the Horizons process is pretty complicated. Actually, over 200 different formulations have been developed over the years, each with its own image color, exposure speed, spectral sensitivity, substrate, and other characteristics. All of them, though, are non-silver, and all deliver extremely high resolution.

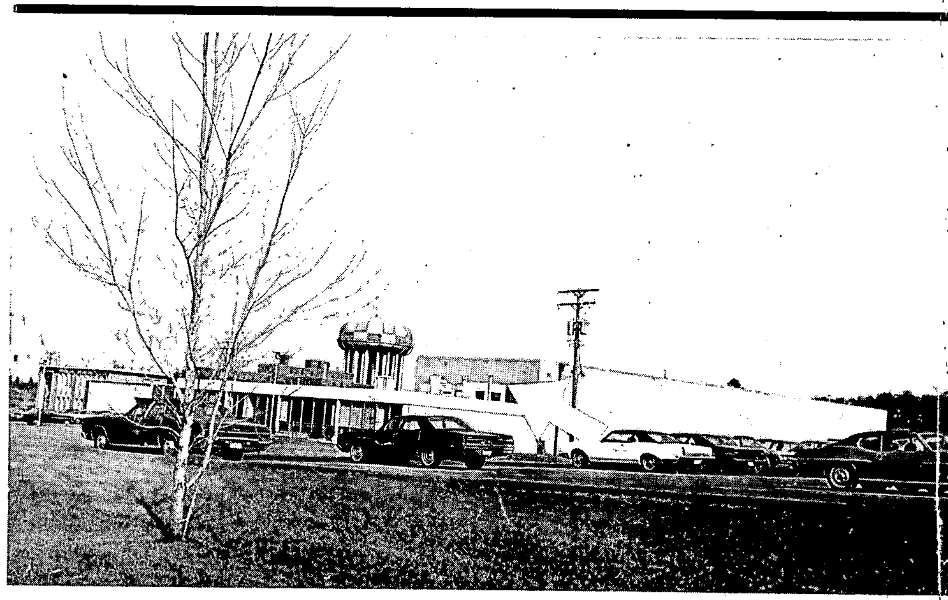
"Free Radical," the original name of the company's film, is not altogether accurate any more. The chemical term was adopted as a trade name in the early days of research because certain free radical elements are formed when the materials are exposed to light. The present systems are described more accurately as a sort of "chain reaction" set off by light, in which a dye is created within the film in the presence of an activator. This, in a sense, "amplifies" the effect of the light.

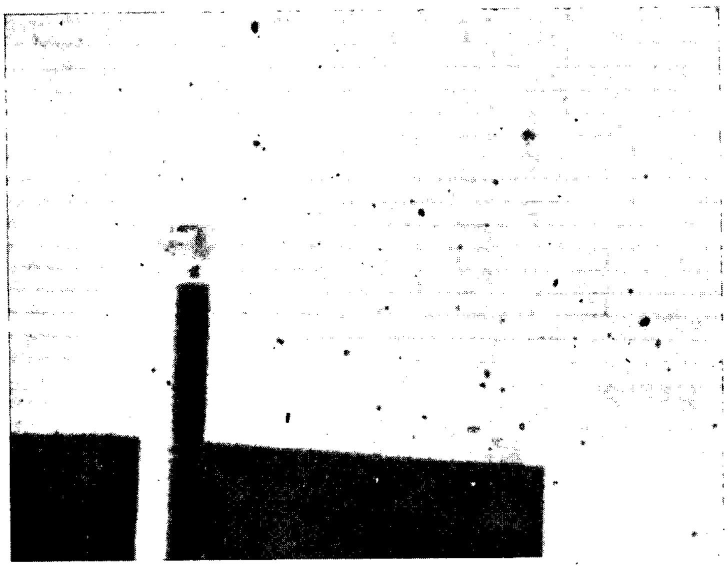
Peak sensitivity of the material lies about the mercury line on the spectrum—some 360 nanometers. Both gamma and D-max can be varied by changes in the heating of the air stream which "develops" the negative film. Gamma can be varied from 0.9 to over 2, D-max from 1.8 to 3.

Most remarkable is the resolution obtainable with the film—1000 line pairs per mm. Of course there are shortcomings; principally an exposure index of 0.3 or 0.4—which puts the film behind Brady's wet plates for speed. Now in production is PhotoHorizons' duplicating film used in large volume by the government for copying aerial reconnaissance films, and commercially for duplication of microfilm. Speaking of PhotoHorizons' film for camera use, Mr. Whitner notes that to his knowledge no other non-silver process can conveniently be used to take pictures in the camera either. "Much work needs to be done, however, before this system is perfected."

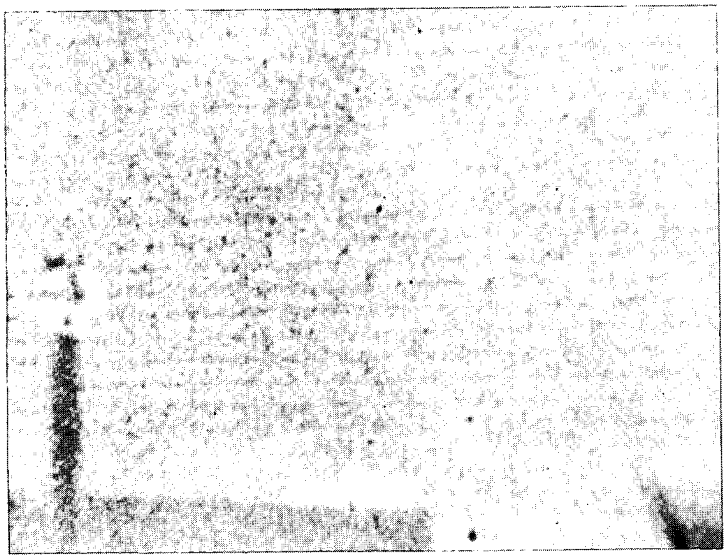
Perfect or not, it seems that there should be applications for such a high-resolution film other than making photographs from a speeding airplane. Architectural work, for one; photofabrication for another. □



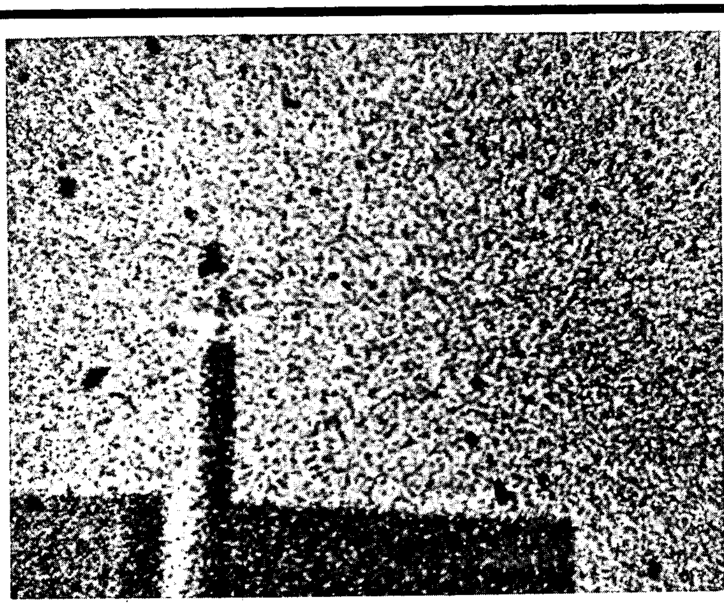




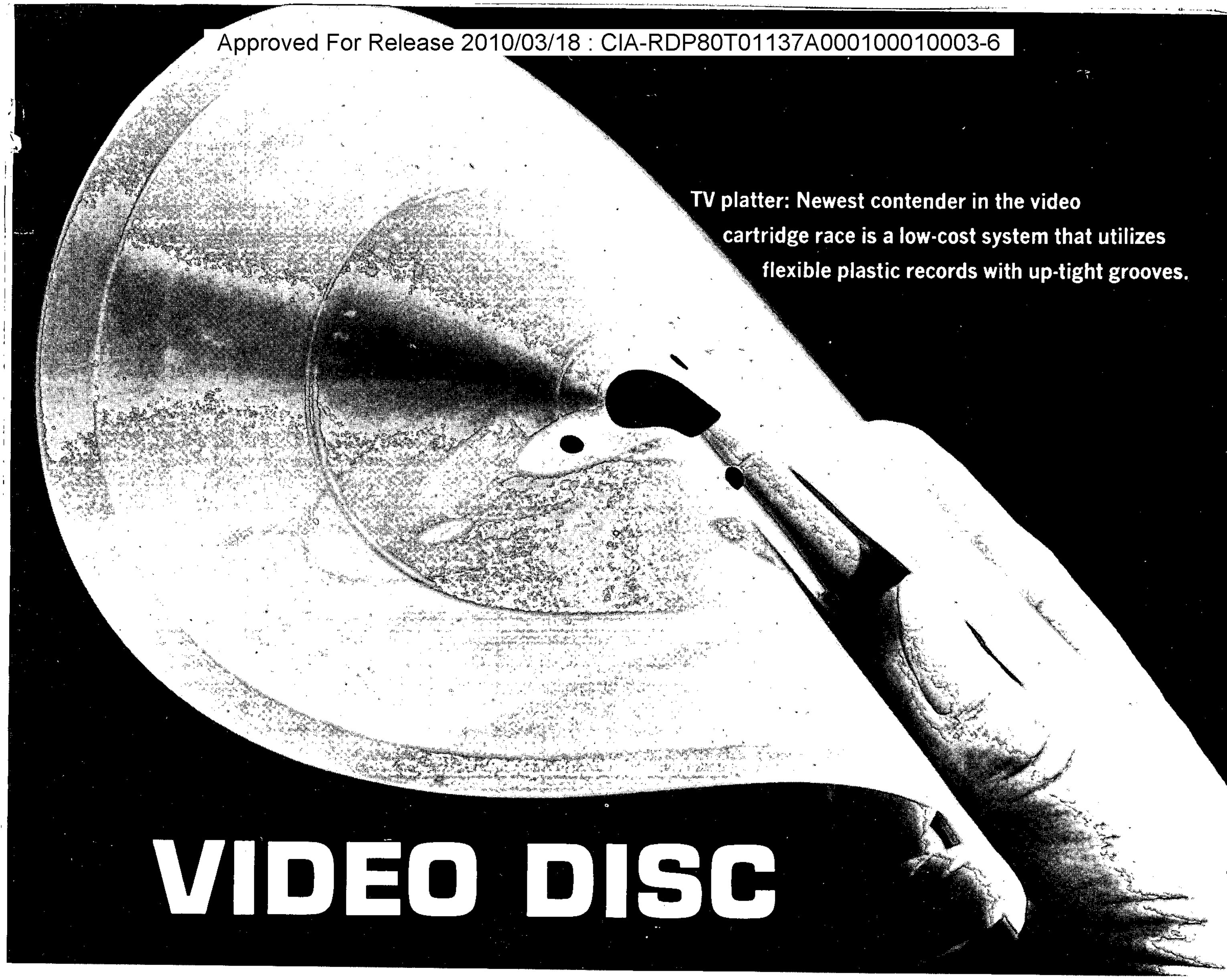
Arrow in general view, left, points out area of Free Radical negative enlarged 100X. ASA of film is between 0.3 and 0.4, but with pretty good color rendition and really wild resolution, who cares about speed? Print is messy because experimental film was hand coated.



High resolution aerial silver film has an ASA rating of 8, but the material's relatively high speed (ASA 8!) has to be paid for in increased grain size. Present aerial films are adequate for the job they do, but as the saying goes, how American it is to want something better.



Panatomic-X is regarded as a fine grain film, but as the illustration at left shows, it isn't in the same grain league as the high resolution aerial stocks, silver or non. This stock is adequate for day-to-day use, which shows how much farther technology is than we think.



VIDEO DISC

Old Thomas Alva What'sisname would probably do a quick double-take if he could see the latest addition to the gramophone family tree. Created by British Decca and Telefunken, the Teledec video disc system uses what looks like phonograph records to play pictures and sound over an ordinary TV set.

A first cousin to EVR, SelectaVision, and a number of videotape cartridge playback systems, the Teledec video player is about the size of a portable record player. The record itself is of thin, flexible plastic foil with the grooves much more closely spaced than those of an audio record, giving it a storage density 100 times greater.

The video disc player, unlike the conventional phonograph, has no revolving turntable. The thin disc is driven by a precision spindle in the center of a fixed circular table. At spindle speeds of 1,500 rpm—a rate at which the disc on a normal turntable would flatten—a thin cushion of air is formed between the fixed table and the record, preventing any friction between the two surfaces.

Also unlike its ancestor, the phonograph, the pickup arm of the player does not progress across the record by groove walls. Instead, it travels in a straight line across the record, translating the impressions on the surface of the disc into electronic impulses by a method called "pressure pick-up." Information is picked up off the record at up to 3 MHz by an unsymetrically-shaped diamond stylus. The front of the stylus is shaped with a gradual radius, and the opposite side with a sharp edge, enabling it to glide easily over the groove modulation much like a sleigh runner. The actual traverse of the disc is accomplished by mechanically coupling the pick-up arm mounting to the rotation of the spindle. For each single revolution of the disc—which produces one complete TV frame—the pick-up moves over the